W. I. A.—2. Issued July 10, 1915.

United States Department of Agriculture,
BUREAU OF PLANT INDUSTRY,
Western Irrigation Agriculture,
WASHINGTON, D. C.

THE WORK OF THE HUNTLEY RECLAMATION PROJECT EXPERIMENT FARM IN 1914.[1]

By Dan Hansen, *Farm Superintendent.*

INTRODUCTION.

The experiments carried on at the Huntley Experiment Farm are concerned chiefly with crops grown under irrigation. The experiments include crop rotation and tillage methods, variety tests of field crops, tests of cropping methods, pasture-grass tests, and tests of fruit trees, small fruits, and vegetables. The arrangement of the fields and the location of the experiments are shown in figure 1. The buildings and a portion of the farm are shown in figure 2. In addition to the area under irrigation a 40-acre tract of land lying above the irrigation canal is used for experiments with dry-land crops. This work is under the direction of the Office of Dry-Land Agriculture and includes crop-rotation and tillage experiments.

The work of the farm previous to 1914 has been reported upon in publications of the Department of Agriculture [2] issued in 1913 and 1914. This paper reports the more important features of the work done and results accomplished in 1914.

[1] The Huntley Experiment Farm is located on the Huntley Reclamation Project, adjacent to the town site of Osborn, Mont. It comprises about 200 acres of public land withheld from entry by the Department of the Interior at the time of the opening of the project, to be used as an experiment farm. In 1914 the Department of Agriculture was granted the use of two additional tracts, which were originally part of the Osborn town site. One of these tracts contains about 32 acres and lies below the irrigation canal. The other tract contains about 40 acres of dry land. This additional land will be used for experiments in 1915. Of the 200 acres originally set aside for the experiment farm, only about 80 acres are irrigable, some of the land being occupied by two railroads, the main irrigation canal, and a large waste ditch, and part of it lying above the canal. In addition to the land mentioned, a tract of 40 acres of the heavy land near the town of Worden is used for experiments in reclaiming alkali soils. The work of the farm is under the supervision of the Office of Western Irrigation Agriculture. The Office of Dry-Land Agriculture and other offices in the Bureau of Plant Industry and the Montana Agricultural Experiment Station are cooperating in the investigational work.

[2] See Hansen, Dan, "The Work of the Huntley Experiment Farm in 1912," in Bureau of Plant Industry Circular 121, pp. 19–28, 1913; "The Work of the Huntley Reclamation Project Experiment Farm in 1913," an unnumbered circular of the Office of Western Irrigation Agriculture, 1914; "Experiments in the Production of Crops on Alkali Land on the Huntley Reclamation Project, Montana," Bulletin 135, U. S. Department of Agriculture, 1914.

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CONDITIONS ON THE PROJECT.

CLIMATIC CONDITIONS.

The rainfall at the Huntley Experiment Farm during 1914 was slightly below normal. The average for the past four years was 13.18 inches, while in 1914 it was 12.21 inches. The frost-free period was 147 days, which was 17 days longer than the average for four years. Table I gives a summary of the climatological observations made during the past four years.

TABLE I.—*Summary of climatological observations made at the Huntley Experiment Farm, 1911 to 1914, inclusive.*

PRECIPITATION (INCHES).

Year.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Total
1911	0.64	0.32	.....	0.85	3.29	2.13	0.81	1.05	0.57	0.88	0.82	0.13	11.49
1912	.27	.21	0.41	2.00	2.44	1.14	2.25	1.39	2.97	3.25	.75	.....	17.08
1913	.29	.10	.40	.43	1.27	2.20	1.10	1.19	1.43	2.89	.45	.17	11.92
1914	.11	.19	.52	1.16	2.83	3.31	.05	.76	1.90	1.07	.07	.24	12.21
Average	.33	.20	.33	1.11	2.48	2.19	1.05	1.10	1.72	2.02	.52	.13	13.18

EVAPORATION (INCHES).

1911	.....	.....	.....	4.388	5.827	7.124	8.875	6.071	5.079	2.568	.....	.....	39.932
1912	.....	.....	.....	.....	4.900	7.020	6.942	6.959	3.722	2.475	.....	.....	32.018
1913	.....	.....	.....	.....	4.300	5.980	7.020	6.300	4.450	.....	.....	.....	28.050
1914	.....	.....	.....	2.770	4.336	4.936	7.778	7.216	4.284	.....	.....	.....	31.320
Average	.....	.....	.....	3.579	4.841	6.265	7.654	6.636	4.384	2.521	.....	.....	32.830

DAILY WIND VELOCITY (MILES PER HOUR).

Average:													
1911	.....	.....	.....	5.6	5.6	4.5	4.6	4.0	4.4	4.2	5.4	5.5	.....
1912	5.6	5.2	4.8	5.8	6.3	5.2	3.9	3.7	4.2	5.6	4.2	7.8	.....
1913	6.3	5.9	5.2	6.3	4.5	3.8	3.7	3.2	3.6	4.0	.....	.....	.....
1914	.....	.....	5.3	5.1	4.0	3.2	2.7	3.2	3.5	2.5	3.5	2.5	.....
Maximum:													
1911	.....	.....	.....	9.4	8.8	8.8	8.7	7.2	9.3	10.0	11.6	11.5	.....
1912	12.8	10.8	12.1	13.0	17.5	7.7	6.0	6.5	8.0	14.7	9.7	14.6	.....
1913	11.9	12.6	10.5	10.1	9.2	5.4	8.6	5.7	8.8	8.3	.....	.....	.....
1914	.....	.....	8.7	10.1	8.5	6.7	5.6	6.4	9.6	5.6	6.4	8.1	.....
Minimum:													
1911	.....	.....	.....	2.0	1.5	2.7	2.3	2.1	1.0	1.3	1.4	1.5	.....
1912	.7	1.6	.9	2.6	1.8	2.3	.6	.8	.9	1.5	1.0	2.7	.....
1913	1.0	1.7	1.9	1.0	.9	1.3	2.1	.8	.4	1.5	.....	.....	.....
1914	.....	.....	1.6	2.1	1.7	1.6	.3	1.4	1.3	1.1	.8	.6	.....

MONTHLY TEMPERATURE (°F.).

Mean:													
1911	14.2	16.1	39.1	43.2	53.8	68.5	67.6	64.1	58.2	44.8	24.9	23.6	.....
1912	16.6	29.1	18.7	46.5	55.5	66.8	67.2	66.6	50.1	44.7	38.7	29.7	.....
1913	14.0	17.7	24.0	46.4	55.0	65.9	68.0	70.0	57.3	41.0	38.2	30.6	.....
1914	27.0	19.0	36.0	45.0	56.0	63.0	75.0	68.0	58.0	48.0	39.0	15.0	.....
Maximum:													
1911	50.0	40.0	74.0	77.0	92.0	94.0	97.0	97.5	94.0	84.5	55.0	55.0	.....
1912	53.0	52.0	62.0	78.0	90.0	99.5	95.0	93.0	89.0	79.0	69.0	59.0	.....
1913	56.0	63.0	61.0	82.0	89.0	88.0	98.0	97.0	94.0	81.0	67.0	55.0	.....
1914	58.0	54.0	68.0	75.0	83.0	93.0	100.0	99.0	89.0	80.0	69.0	48.0	.....
Minimum:													
1911	−26.0	−19.0	− 3.0	17.0	24.0	40.0	41.0	33.5	28.0	14.0	−20.5	−26.0	.....
1912	−35.0	− 5.0	−27.0	20.0	32.0	36.0	44.0	40.0	24.0	17.0	13.0	1.0	.....
1913	−32.0	−21.0	−25.0	20.0	31.0	42.0	43.0	44.0	29.0	20.0	14.0	− 5.0	.....
1914	− 6.0	−38.0	− 3.0	17.0	22.0	36.0	44.0	38.0	33.0	24.0	− 3.0	−23.0	.....

TABLE I.—*Summary of climatological observations made at the Huntley Experiment Farm, 1911 to 1914, inclusive*—Continued.

KILLING FROSTS.

Year.	Last in spring.		First in autumn.		Frost-free period.
	Date.	Minimum temperature.	Date.	Minimum temperature.	
		°F.		°F.	*Days.*
1911	May 26	32	Sept. 18	28	114
1912	May 13	28	Sept. 16	31	125
1913	May 5	31	Sept. 19	29	136
1914	May 12	32	Oct. 6	31	147

CROP CONDITIONS.

In most respects the crop season of 1914 was very favorable, being free from any specially severe weather conditions. The winter of 1913-14 was unusually open and mild. Spring rains furnished sufficient moisture to promote good germination of all crops, and irrigation was not necessary until the crops were well started. The harvest season for sugar beets and other late crops was very favorable, and this work was completed in good season.

An invasion of the alfalfa looper that occurred early in June damaged to some extent the first cutting of alfalfa and also corn, sugar beets, and garden crops. The stay of this insect was short, so that the damage to crops, other than the first cutting of alfalfa, merely checked their growth for a short time.

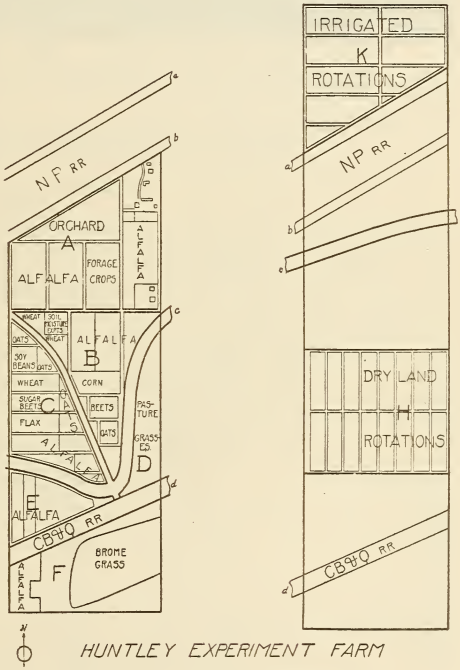

FIG. 1.—Diagram of the Huntley Experiment Farm, showing the arrangement of the fields and the location of the experiments in 1914.

In 1914 there were 526 farm units in operation on the project. These farms comprised an irrigable area of 23,160 acres. Of this, an area of 17,068 acres was in crops. Of the crops grown, alfalfa occupied 6,107 acres; sugar beets, 4,274 acres; and grains, chiefly oats and wheat, 5,766 acres. The total farm value of the crops grown in 1914 was $454,583, as compared with $464,697 in 1913.

The average farm value per acre of crops was $26.63 in 1914, as compared with $29.35 the preceding year. The decrease in total value and in average value per acre was due largely to the fact that alfalfa hay was valued at $5 a ton in 1914 and at $5.50 a ton in 1913. The acreage, yields, and farm values of the crops grown on the project in 1914 are shown in Table II, the figures being obtained from the United States Reclamation Service.

FIG. 2.—The buildings and some of the experiment fields on the Huntley Experiment Farm.

TABLE II.—*Acreage, yields, and farm values of crops produced on the Huntley Reclamation Project in 1914.*

Crop.	Area (acres).	Unit of yield.	Yields.			Farm values.			
			Total.	Average.	Maximum.	Per unit of yield.	Total.	Per acre.	
								Average.	Maximum.
Alfalfa	6,038	Ton	17,440	2.9	6.2	$5.00	$87,200	$14.45	$31.00
Alfalfa seed	69	Bushel	419	6.1	18	7.00	2,933	42.50	126.00
Barley	363	do	6,689	18.4	50	.53	3,545	9.75	26.50
Bluestem	160	Ton	214	1.34	2	12.00	2,568	16.08	24.00
Beans	40	Bushel	511	12.8	16	3.00	1,533	38.60	48.00
Corn	497	do	11,755	23.75	75	.62	7,288	14.65	46.50
Clover hay	36	Ton	59	1.66	3	12.00	708	19.80	36.00
Cucumbers	32	Pound	303,000	9,469	14,500	.0125	3,788	118.36	181.25
Grain hay	15	Ton	20	1.31	2	6.00	120	7.88	12.00
Fodder	56	do	85	1.52	5	6.00	510	9.12	30.00
Millet	8	do	12	1.5	2	6.00	72	9.00	12.00
Oats	3,226	Bushel	96,014	29.8	92	.32	30,724	9.54	29.44
Potatoes	120	do	10,680	89	325	.62	6,622	55.18	201.50
Peas	51	do	470	8.44	9.2	.75	353	6.37	6.90
Rye	9	do	28	3.1	3.1	.60	17	1.87	1.86
Spelt	8	do	32	4	4	.80	26	3.20	3.20
Sugar beets	4,274	Ton	41,030	9.6	21.5	6.00	246,180	57.60	129.00
Timothy	138	do	184	1.33	2.5	12.00	2,208	15.95	30.00
Truck	265		14,401			75.00	19,875	75.00	75.00
Wheat	1,663	Bushel	39,095	23.5	75	.98	38,313	23.03	73.50
Total or average	17,068						454,583	26.63	

LIVE STOCK.

Interest in live-stock industries, particularly dairying and swine production, is increasing rapidly on the project. During the year 1914 the number of cattle increased from 1,844 to 2,921, or about 60 per cent. During the same period, the number of hogs increased

from 2,023 to 4,612, or about 128 per cent. Of the 2,921 head of cattle on the project on December 31, 1914, 789 were dairy cows and 133 were calves. A detailed statement of the numbers of live stock on the project on January 1 and December 31, 1914, is given in Table III, the figures being obtained from the United States Reclamation Service.

TABLE III.—*Live stock on the Huntley Reclamation Project in 1914.*

Item.	Inventory, Jan. 1.			Inventory, Dec. 31.			Increase or decrease in total value.
	Number.	Average value of each.	Total value.	Number.	Average value of each.	Total value.	
Horses	1,656	$121.55	$201,287	2,008	$108.88	$218,640	$17,353
Mules	57	150.00	8,550	53	134.90	7,150	−1,400
Cattle	1,844	48.69	89,784	2,921	47.45	138,625	48,841
Sheep	2,784	4.00	11,136	847	3.22	2,730	−8,406
Hogs	2,023	9.14	18,490	4,612	9.68	44,536	26,046
Fowls	19,608	.53	10,392	23,345	.49	11,356	964
Bees, hives	58	4.30	249	247	3.07	758	509
Total			339,888			423,795	83,907

EXPERIMENTS WITH IRRIGATED CROPS.

CROP ROTATIONS.[1]

In the spring of 1912 a series of crop rotations under irrigation was begun in field K, 70 quarter-acre plats being used for this work. The crops included in these rotations are alfalfa, oats, potatoes, beets, corn, wheat, and flax. The value of various crop sequences is being determined in three 6-year, three 4-year, three 3-year, and eleven 2-year rotations. Nine of the plats are devoted to the continuous production of the above-named crops on the same land each year, so that a comparison can be made between the value of continuous cropping and that of crop rotation.

The results of the work in 1913 and 1914 show some very noticeable differences in the yields of some of the crops. The information obtained thus early in the history of the rotations, however, is necessarily preliminary, and any conclusions drawn from it are tentative. It will require a long period of years to obtain conclusive results from most of this work. The results so far secured are, however, of some value, and some of the more important are herein considered.

The average, maximum, and minimum yields obtained in 1913 and 1914 are given in Table IV.

[1] These experiments were under the immediate supervision of Mr. John W. Knorr, assistant, who prepared the report here made.

TABLE IV.—*Average, maximum, and minimum yields obtained in the irrigated rotation experiments at the Huntley Experiment Farm in 1913 and 1914.*

Crop.	Variety.	Number of plats.	Unit.	Yield per acre.					
				Average.		Maximum.		Minimum.	
				1913	1914	1913	1914	1913	1914
Alfalfa [1]	Montana	10	Ton	5.46	5.41	6.29	6.26	4.21	4.46
Alfalfa [2]	do	6	do	2.20	2.22	2.51	2.59	1.79	1.47
Sugar beets	Kleinwanzlebener	14	do	13.08	11.16	16.80	15.09	9.25	6.67
Potatoes	Rural New Yorker	13	Bushel	212.69	167.80	362.00	293.30	36.00	5.50
Oats	Swedish Select	15	do	84.16	89.82	126.80	115.00	37.80	45.75
Wheat	Pringle Champion	3	do	27.25	32.69	36.12	40.73	17.44	22.93
Corn	Northwestern Dent	4	do	41.97	42.90	48.70	55.08	33.90	31.63
Flax	Minnesota No. 25	2	do	21.71	18.63	31.28	24.29	12.14	12.98

[1] Second and third year alfalfa. [2] First-year alfalfa.

The average yield for six plats of alfalfa that were seeded in the spring of 1914 was 2.22 tons per acre. The plats that were seeded in the spring of 1912 yielded an average of 5.06 tons per acre in 1914, which was their third year. Two-year-old alfalfa, or that which was seeded in 1913, yielded an average of 5.40 tons per acre. It is a popular belief among farmers that alfalfa does not reach the stage of maximum productiveness until it is at least 3 years old; but this belief is not supported by the above figures, which show that in this instance there was practically no difference in the yields secured from second-year and third-year alfalfa.

The average yield of beets in these experiments was 11.16 tons per acre in 1914, as compared with 13.08 tons in 1913. The highest yield in 1914 was obtained on land which produced potatoes in 1913. The lowest yield was obtained on land which was in oats in 1913. When beets were grown on manured oat land the yields were much better than where no manure was used. Beets were grown on eight plats that were in oats the preceding season. Three of these plats were manured. The average yield of the beets on the manured plats was 12.99 tons, while the average on the five plats without manure was 8.47 tons. The fact that the best yields were secured on potato land suggests that beets do better when following a cultivated crop, cultivation apparently producing a favorable effect upon the physical condition of the soil. The average sugar content of the beets from all plats was 17.2 per cent in 1914, as compared with 15.6 per cent in 1913.

The best yield of potatoes was secured on alfalfa land, the yield being 293.3 bushels per acre. The yields obtained from the potatoes in 1914 were not very satisfactory. A new variety will be tried in 1915. During the past two years it has been found practically impossible to raise satisfactory crops of potatoes on land on which rye is planted in the fall and plowed under as green manure in the spring before the potatoes are planted. This practice makes it very difficult to secure a good seed bed for the potatoes.

The average yield of oats was slightly better in 1914 than it was in 1913. The best yield obtained in 1914 (115 bushels per acre) was on land that produced potatoes in 1913. A view of this plat is shown in figure 3. The lowest yielding plat was where oats followed oats, the yield being only 45.75 bushels per acre. Of the 15 plats planted to oats in 1914 the highest yielding ones were those where oats followed beets or potatoes. The lower yielding plats were those following corn, wheat, or oats.

The season of 1914 was more favorable for the production of corn than 1913, because of the greater length of the frost-free period and the warmer weather during the summer. The highest yield of corn was 55.08 bushels; this was secured on land that was in potatoes the

FIG. 3.—Plat K-IV-5, oats following potatoes on manured land in the rotation experiments. This plat yielded at the rate of 115 bushels per acre in 1914.

previous season. The lowest was 31.63 bushels, obtained on the plat that is planted to corn every year. This shows a marked difference in favor of crop rotation as compared with continuous cropping.

Wheat yielded best after beets, and the lowest yield was in the 2-year rotations where wheat followed oats.

There are only two plats of flax, one of which is in a 6-year rotation following corn (hogged) and the other is a continuously cropped plat. The flax in the rotation yielded 24.29 bushels per acre in 1914 and 31.28 bushels per acre in 1913, while the yields on the other plat were, respectively, 12.98 and 12.40 bushels. The yields of flax in the rotation have been from two to two and one-half times greater than those on the continuously cropped plat.

The results obtained from the rotation experiments in 1914 indicate particularly that (1) crops grown in rotation can be expected to yield more than when grown continuously on the same land, (2) the practice of plowing under alfalfa or applying manure greatly increases the productivity of the soil, and (3) the growing of cultivated crops in a rotation usually has a beneficial effect upon the subsequent crop.

Pasturing corn and alfalfa with hogs.—In rotation 67, which consists of corn, flax, beets, and three years of alfalfa, the third-year alfalfa and the corn plat are harvested by hogs instead of in the usual manner. The object of this work is to ascertain the value of alfalfa hay and of corn when harvested by hogs.

The alfalfa pasture was divided into two seasons, the spring season extending from about April 20 to July 1 and the summer season from July 1 until the latter part of September. On the spring pasture fall pigs were used, while spring pigs pastured the summer growth. The quarter-acre plat was divided into two equal parts. The hogs were transferred from one part to the other about every ten days. Each half of the plat was irrigated when unoccupied by the hogs. The pasture maintained hogs at the rate of about 2,500 pounds of live weight to the acre. In addition to the pasture the hogs received 2 pounds of shelled corn per day for each hundred pounds of live weight.

On April 27 four Hampshire hogs, having a total weight of 451 pounds, were turned out on the pasture, where they remained until July 5. On July 7 nine Duroc-Jersey pigs were placed on the plat, where they remained until September 15. They weighed 41 pounds each on July 7, their total weight being 368 pounds. These pigs are shown in figure 4. The total quantity of pork produced by the two lots of hogs while on pasture was 512½ pounds. During the time they were on the alfalfa pasture, 1,333 pounds of grain were consumed. The average yield of alfalfa in the other rotations was 4.64 tons per acre. Allowing 7 cents a pound, live weight, for the hogs, the gains were worth $35.88. After deducting the cost of the corn consumed, valuing corn at $1.25 per hundredweight, it is seen that the net returns were $19.22 for the quarter-acre of alfalfa pasture, or $76.88 per acre. Assuming that this plat produced 4.64 tons of hay per acre, $76.88 was realized for that quantity of hay, or $16.60 per ton, when pastured by hogs. In addition to this the cost of harvesting was saved and the value of manure added through pasturing should also be considered. The spring pigs made much better gains than the fall pigs.

These results and also those secured in 1913 indicate that the practice of pasturing alfalfa with hogs should receive careful consideration by the farmers on the Huntley project.

Hogging corn.—On September 22 four of the spring pigs that had been on the alfalfa pasture were transferred to the corn plat in the same rotation. At this time these pigs had an average weight of 86 pounds or a total weight of 345 pounds.

The corn was practically all matured when the hogs were turned on it. To make a thorough cleaning of the plat 22 days were required. When the hogs were removed their weight was 569 pounds, the gain having been 224 pounds. The yield of this plat was estimated at 12.6 bushels, or 50.24 bushels per acre. At 7 cents a pound the gains in the pigs' weight were worth $15.68 or $62.72 per acre.

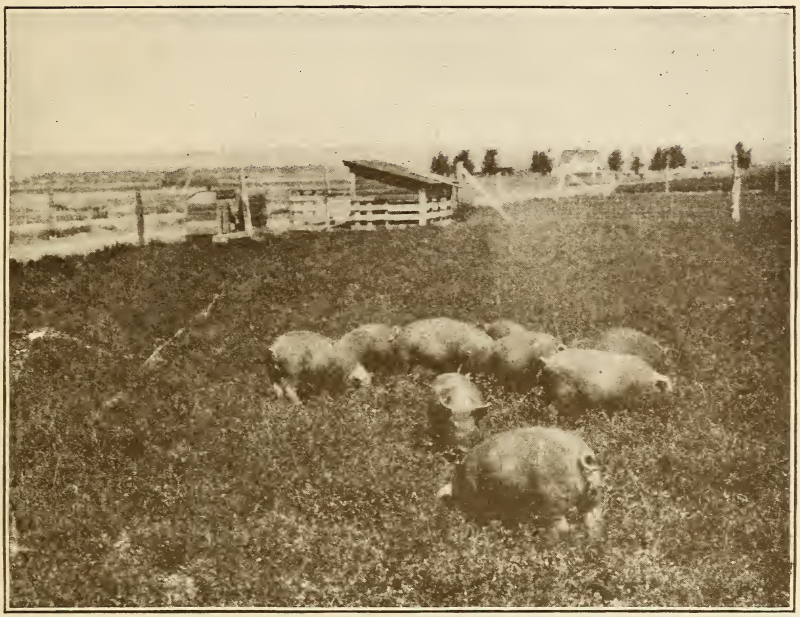

FIG. 4.—Spring pigs on alfalfa pasture in rotation 67. The gains made by pigs on this plat in 1914 were equivalent to $16.60 a ton for the alfalfa consumed, or $76.88 per acre of alfalfa.

The gains were made from 12.6 bushels of corn, so that the hogs paid $1.24 per bushel for the corn consumed. The value of the manure and the saving of labor in harvesting should also be added. It is thus apparent that hogging corn is a practice which might well be followed by farmers on the project who grow corn and hogs.

EXPERIMENTS WITH ALFALFA.

Time and method of seeding.—In 1911 an experiment in time and method of seeding alfalfa was started on 13 quarter-acre plats in field A–IV. The same experiment was repeated in 1912 in field A–III. The experiment included the following: Seeding early with wheat as a nurse crop, seeding late without a nurse crop, seeding

early without a nurse crop, and seeding late in 18-inch rows. In 1911 the early sowing was done on May 5 and the late sowing on June 5; in 1912 the dates were May 11 and June 14, respectively. In each field the plats were triplicated, except in the case of the nurse-crop seeding, which was quadruplicated. The seeding rate of alfalfa was 12 pounds per acre on all plats except those in 18-inch rows, where it was 6 pounds per acre. The seeding rate of wheat on the nurse-crop plats was 1 bushel per acre. From both fields three years' results in the production of hay have been obtained, in field A–IV from 1911 to 1913, inclusive, and in field A–III from 1912 to 1914, inclusive.

A summary of the yields is presented in Table V. The yields given are an average of three plats, except on the nurse-crop plats, of which there were four. In field A–III all of the nurse-crop plats were cut for grain the first year, while in field A–IV two plats were cut for grain and two for hay.

TABLE V.— *Yields of alfalfa and wheat obtained in field A–IV in 1911, 1912, and 1913, and in field A–III in 1912, 1913, and 1914, at the Huntley Experiment Farm.*

Time and method of planting.	Average yield per acre (tons).							
	Field A–III.				Field A–IV.			
	1912	1913	1914	Total, 3 years.	1911	1912	1913	Total, 3 years.
Early	2.16	4.79	5.22	12.17	2.43	5.64	5.23	13.30
Late	.53	4.71	5.08	10.32	2.00	5.35	5.45	12.80
18-inch rows	.24	3.79	4.49	8.52	1.75	4.98	5.11	11.84
Nurse crop cut for grain	44.2	4.25	5.12	[1] 9.37	46.7	4.93	5.68	[2] 10.59
Nurse crop cut for hay	.....	.....	.....	.....	2.34	5.40	5.56	[3] 10.96

[1] Plus 44.2 bushels of wheat. [2] Plus 46.7 bushels of wheat. [3] Plus 2.34 tons of wheat hay.

Table V indicates that in both fields the yields of alfalfa in the first year were in favor of early seeding, but there was not enough difference in the yields during the second and third years to be significant except in the case of the plats in 18-inch rows. This difference was greater in field A–III than in field A–IV. The plats in 18-inch rows yielded in field A–III during the second year nearly a ton less per acre than the average of the other plats. The yields during the third year varied less than during the second year, although the yields of the 18-inch-row plats were lower in both fields.

When the total yields for three years are considered it is seen that the early seeding in both fields produced a larger quantity of hay than either of the other methods, in field A–III by nearly 2 tons and in field A–IV by half a ton per acre. The lowest production for the three years was from the 18-inch-row planting. Consideration should be given the yields of wheat, hay, and grain during the first year on the nurse-crop plats.

The relative values of the crops produced under the different methods for three years are shown in Table VI. The values are based on the yields obtained and the cost of production by the different methods.

Alfalfa and wheat hay are valued at $6 per ton and wheat at 65 cents per bushel, which were the average current prices while the experiment was in progress.

TABLE VI.—*Gross and net values and cost of production of crops in the alfalfa-seeding experiment on field A–IV at the Huntley Experiment Farm in 1911, 1912, and 1913, and in field A–III in 1912, 1913, and 1914.*

Field.	Nurse crop cut for hay (2 plats).	Nurse crop cut for grain (4 plats).	Time of planting.		
			Early (3 plats).	Late (3 plats).	18-inch rows (3 plats).
Field A–III:					
Gross value		$84.95	$73.02	$61.92	$51.12
Cost of production		32.18	29.04	26.02	23.23
Net value		52.77	43.98	35.90	27.89
Field A–IV:					
Gross value	$79.80	94.01	79.80	77.80	71.04
Cost of production	34.12	37.86	36.06	33.78	31.46
Net value	45.68	[1] 56.15	43.74	44.02	39.58
Average net value, fields A–III and A–IV	45.68	54.46	43.86	39.96	33.73

[1] Two plats.

The figures show that in both fields the highest returns were obtained from the nurse-crop plats, the lowest returns from the plats in 18-inch rows, and that there was not much difference in the returns from early and late seeding, although the early seeding had a slight advantage.

Time of harvesting.—The test which was started in 1913 on 10 quarter-acre plats in field A–I to determine the effect of cutting alfalfa at different stages of growth was continued in 1914 on the same plats. The plan of the test provided for harvesting the first plat in each crop at the time of the first appearance of the basal shoots and each succeeding plat at 5-day intervals thereafter. The test was conducted on duplicate plats, making five pairs of plats, so that there was an interval of 20 days between harvesting the first and the last plat. A rain occurred at about the time the first plats in the first crop were ready to cut, which made it impossible to harvest them at the proper time, so that the first two pairs of plats were harvested on the same date. For the remainder of the first crop and for the second and third crops the plan was followed as outlined. Table VII gives the yields obtained during the season of 1914. The yields in each case are the average of two plats.

TABLE VII.—*Yields of alfalfa obtained in the time-of-cutting experiment at the Huntley Experiment Farm in 1914.*

[Tons per acre.]

First crop.		Second crop.		Third crop.		Fourth crop.		Number of crops.	Total yield.
Date cut.	Yield.	Date cut.	Yield.	Date cut.	Yield.	Date cut.	Yield.		
June 12	2.01	July 16	1.64	Aug. 25	1.46	Oct. 12	1.30	4	6.41
June 12	1.86	July 21	1.63	Sept. 1	1.58	Oct. 12	.74	4	5.81
June 18	1.82	July 26	1.58	Sept. 4	1.39	.....	.....	3	4.79
June 22	1.71	July 31	1.59	Sept. 9	1.50	.....	.....	3	4.80
June 27	1.99	Aug. 5	2.40	Sept. 15	.....	.....	.....	3	4.39

The results show that there were no consistent differences in the yields of the second crop due to delay in harvesting the first crop. They differ in this respect from the results obtained in 1913. In that year the yields of the second crop increased with the length of the growing period of the first crop.

In considering the total yields it is seen that on the plats where four crops were harvested the total yield was much higher than the total yields from plats that were cut only three times. In this connection only the first four sets of plats can be considered, as the weights of the third crop on the last two plats were lost. The yields of the fourth crop were higher than can be expected in an ordinary season, since the date of the first fall frost was nearly three weeks later than usual.

Shrinkage determinations.—In connection with the time-of-cutting test with alfalfa in field A–I, determinations of the amount of shrinkage in alfalfa cut at different stages of growth have been made. From each plat at the time of cutting a 10-pound sample of green alfalfa was taken, weighed, and hung up in a burlap bag in a dry shed, where it was left for about four weeks, or until the alfalfa was thoroughly air dried. Table VIII gives the results of these determinations. The results are the average in each case of two samples. The loss of weight on drying is expressed as a percentage of the green weight.

TABLE VIII.—*Determinations of shrinkage in alfalfa cut at different dates at the Huntley Experiment Farm in 1914.*

First crop.		Second crop.		Third crop.	
Date cut.	Loss in weight.	Date cut.	Loss in weight.	Date cut.	Loss in weight.
	Per cent.		*Per cent.*		*Per cent.*
June 12	77.8	July 16	84.7	Aug. 25	78.7
June 12	78.1	July 21	75.9	Sept. 1	77.2
June 18	71.9	July 26	73.1	Sept. 4	80.9
June 22	73.7	July 31	72.8	Sept. 9	81.9
June 27	70.9	Aug. 5	73.4	Sept. 15	74.1
Average of 10 samples.	74.5	.....	76.0	.....	78.6

The results indicate that the amount of shrinkage in the second and third crops was slightly more than in the first. There was no very consistent difference in the amount of shrinkage in the first crop as the length of the growing period increased, although the shrinkage was less in the pair of plats cut last than in those which were harvested earlier. The average shrinkage for the three crops was 76.3 per cent, which is within 0.2 per cent of the average obtained on the same plats in 1913.

Seed production.—Field A–IV, which was used for the experiment in time and methods of seeding alfalfa in 1911, 1912, and 1913, was devoted to a test in the production of alfalfa seed in 1914. The success of this test was hindered to a large extent by an invasion of the alfalfa looper, which occurred at the time the first crop of alfalfa was in bloom. The plan of the test included the following: Harvesting the first crop for hay at the usual time and leaving the second crop to make seed, clipping the first crop when about 8 to 10 inches high and leaving the second growth to make seed, and leaving the first crop to make seed.

There is a wide variation in the soil in this field, the southern half of the field being very heavy, while the northern half is comparatively light and sandy. It was found that irrigating all of the field uniformly when the alfalfa was in the flowering stage had the effect of starting a second growth of the alfalfa on the lighter soil, so that the seed crop was a failure on this part of the field and only the alfalfa on the heavier soil produced any seed.

In thrashing, difficulty was experienced in adjusting the separator to clean the seed properly, and a part of the seed was lost in this way. Three plats on which the first crop was harvested for hay produced at the average rate of 94 pounds of seed per acre. Two plats that were clipped early produced 144 pounds of seed per acre. Three plats on which the first crop was left for seed produced at the rate of 151 pounds per acre.

Eradication experiment.—In 1913 an experiment in methods of eradicating alfalfa was started on 10 plats of alfalfa planted in 1912 between the tree rows in the orchard in field A.

The outline of the plan of this experiment is as follows:

Plat 1.—Plow 4 to 5 inches deep when the third crop is about 2 inches high; float; replow 8 to 10 inches deep six weeks later.

Plat 2.—Plow 4 to 5 inches deep, as in plat 1; leave rough; replow 8 to 10 inches deep six weeks later.

Plat 3.—Plow 4 to 5 inches deep when the third crop is ready to be cut; float; replow 8 to 10 inches deep late in the fall.

Plat 4.—Crown immediately after removing the third crop; harrow; plow 8 to 10 inches deep late in the fall.

Plat 5.—Crown immediately after removing the third crop; harrow; plow 8 to 10 inches deep in the spring of 1914.

Plat 6.—Plow 4 to 5 inches deep immediately after removing the third crop; float; replow 8 to 10 inches deep late in the fall.

Plat 7.—Plow 4 to 5 inches deep late in the fall after the plants are dormant; leave rough; replow 8 to 10 inches deep in the spring of 1914.

Plat 8.—Plow 4 to 5 inches deep early in the spring of 1914 while the plants are still dormant; replow 8 to 10 inches deep about four weeks later.

Plat 9.—Plow 4 to 5 inches deep in the spring of 1914 after the plants are green; harrow; replow 8 to 10 inches deep about three weeks later.

Plat 10.—Crown in the spring of 1914 after the plants are green; harrow; plow 8 to 10 inches deep about three weeks later.

In all cases the plan as outlined was followed except on plats 1 and 2, where it was impossible, because of the ground being too wet as a result of heavy rains in September, to do the second plowing until November 8, three months after the first plowing. In all cases the depth of the first plowing was about 4 inches, and of the second plowing 8 inches. The depth of crowning was 2 to 3 inches. The crowning of plats 4 and 5 was done by means of a special V-shaped blade attached to a small road grader. This attachment is built especially for grubbing sage, but is also sometimes used for crowning alfalfa. The work done by this machine was not entirely satisfactory, because of the difficulty in adjusting it so as to make both sides of the blade run at a uniform depth. The crowning of plat 10 was done with an ordinary moldboard plow equipped with a special alfalfa share.

In 1914 all of the plats in this test were planted to corn. In preparation for planting the corn all of the plats were double disked, harrowed, and leveled uniformly immediately before planting. Northwestern Dent corn was planted on May 27.

All of the corn plats were cultivated three times during the season and were hoed twice. At each hoeing all of the visible alfalfa was cut off. Counts of the number of alfalfa plants per square rod on each plat were made before the first cultivation and again after the corn was harvested. Table IX gives data relating to the various treatments applied to the plats.

TABLE IX.—*Results of the alfalfa-eradication experiment at the Huntley Experiment Farm in 1914.*

Plat.	Date crowned.	Date plowed—		Height at crowning or first plowing.	Harrowed.	Floated.	Number of alfalfa plants per square rod, 1914.	
		First time.	Second time.				On June 22.	On Nov. 2.
				Inches.				
1	.....	Aug. 8, 1913	Nov. 8, 1913	2	.....	Aug. 8, 1913	2	.....
2	.....	.....do.....	.....do.....	2	.....	.....	5	2
3	.....	Sept. 3, 1913	.....do.....	26	.....	Sept. 3, 1913	25	10
4	Sept. 11, 1913	.....	Nov. 9, 1913	.....	Sept. 11, 1913	.....	18	12
5	.....do.....	.....	Apr. 14, 1914	.....	.....do.....	.....	28	20
6	.....	Sept. 11, 1913	Nov. 9, 1913	.....	.....	Sept. 11, 1913	15	10
7	.....	Nov. 9, 1913	Apr. 30, 1914	.....	.....	.....	180	40
8	.....	Apr. 14, 1914	May 27, 1914	.....	Apr. 14, 1914	.....	20	15
9	.....	Apr. 21, 1914	.....do.....	3	Apr. 21, 1914	.....	7	5
10	Apr. 21, 1914	.....	.....do.....	3	.....do.....	.....	10	8

From Table IX it will be noted that at the end of the season the eradication of the alfalfa on plats 1 and 2 was practically complete. Comparing plat 1 with plat 3, in which the only difference was in the time of the first plowing, it appears that eradication is more difficult where the crop is plowed under at full height. In the case of plats 4 and 5 there was a slight difference in favor of doing the second plowing in the fall rather than in the following spring. It appears also that doing the plowing or crowning while the plants were still green was more effective than plowing after the plants were dormant. Plowing the first time to a depth of 4 to 5 inches appeared to be better than crowning.

Corn on these plats in 1914 yielded at the average rate of 62.8 bushels per acre. The highest yield, 70.5 bushels per acre, was secured from plat 3, on which the third crop of alfalfa was plowed under in 1913. On the other plats there were no very significant differences in the yields of corn.

PASTURE GRASSES.

Grasses and grass mixtures.—In 1913 a test of separate pasture grasses on one-twentieth-acre plats and of grass mixtures on one-quarter-acre plats was started in field A–II. The mixtures, which are designated as A, B, and C, and the rate of seeding of each variety in the mixture, are as follows: Mixture A, timothy, 4 pounds; redtop, 4 pounds; Kentucky bluegrass, 4 pounds; orchard grass, 6 pounds; awnless brome-grass (*Bromus inermis*), 6 pounds; meadow fescue, 2 pounds; tall fescue, 2 pounds; Italian rye-grass, 2 pounds; western wheat-grass, 6 pounds; and perennial rye-grass, 2 pounds.

Mixture B was the same as mixture A with the addition of 2 pounds each of white clover and alsike clover per acre. Mixture C was the same as B with the addition of 2 pounds of alfalfa per acre.

The stand obtained with mixtures A and B was at first very light, but it improved as the season advanced and improved still further during 1914. The soil on which these mixtures were sown was very heavy and crusted badly soon after seeding, due to heavy rains, which no doubt had much to do with the difficulty in securing a stand. These two plats were used in 1914 in a pasture test. The stand obtained with mixture C was very good, but this mixture could not be used as a pasture for cows because of the danger of bloat from the large amount of alfalfa growing in the mixture.

Each of the grasses included in these mixtures was sown separately on one-twentieth-acre plats. Excellent stands of all of the grasses were secured except timothy, Kentucky bluegrass, redtop, and western wheat-grass. The grasses that produced the best growth and largest quantities of hay during 1913 and 1914 were awnless

brome-grass, meadow fescue, tall fescue, orchard grass, and tall oat-grass.

Pasturing test.—A test to determine the value and carrying capacity of the grass mixtures was conducted during 1914. In this test two cows were pastured during the growing season on three one-quarter-acre plats. A view of one of these plats is shown in figure 5. Two of these plats were sown in 1913 to mixtures A and B, which were described in the 1913 report, and the third was sown in 1911 to a mixture of awnless brome-grass, 16 pounds; orchard grass, 16 pounds; redtop, 4 pounds; and timothy, 8 pounds per acre. On this plat there was an excellent stand of brome-grass and orchard grass, but practically no redtop or timothy.

FIG. 5.—One of the pastured plats in 1914. This plat was planted to a mixture of grasses and clover in 1913. During 1914 three-fourths of an acre furnished pasture for two cows from April 30 to October 10.

The pasturing test with these three plats was started on April 30. For this purpose the plats containing mixtures A and B were placed in one inclosure, and for the first part of the season, because of the light stand of the grasses, were pastured alternate weeks against the single plat that was planted in 1911.

This arrangement was continued until August 1, when it was found that the grass on the single plat failed to make as rapid growth as earlier in the season, and the pasture produced was insufficient to carry the cows every other week. At the same time the stand on the other two plats was much improved, and from this time until the end of the pasturing period the part of the pasture containing the two plats was pastured for two weeks as against one week for the single plat. Each part of the pasture was irrigated as soon as the cows were removed, so that water was applied to the pasture

every other week during the season. The pasture period ended October 10. The cows were on the pasture continuously during the period with the exception of a few days of stormy weather and one period of ten days, when one of the cows was sick and was kept in the yard. The cows were left on the pasture only during the daytime and were brought to the yard each night and given a supplemental feed of 8 pounds of chopped grain, consisting of equal parts of wheat and oats, and, during the last month, 8 pounds of alfalfa hay.

The results of the pasturing test are very encouraging. Two cows were carried through the season on three-fourths of an acre. This is at the rate of eight cows on 3 acres. This carrying capacity should be very satisfactory to the dairy farmers on the project.

SUGAR BEETS.

Distance of thinning and planting.—An experiment with sugar beets covering width-of-row and distance-of-thinning tests was conducted in field B–VI. In this experiment the beets were planted in rows 18, 20, and 24 inches apart, and in each width-of-row test the beets were thinned to 6, 9, 12, 15, and 18 inches apart in the row. After the thinning, counts of the number of beets in each row were made and the actual average distance apart of the beets in each plat was determined. All plats were triplicated, 45 in all. The average yield of these plats was at the rate of 16.89 tons per acre. The highest yield obtained was from the plats in which the beets were planted in rows 24 inches apart and thinned to 8 inches in the row, the average yield of the three plats being 18.68 tons per acre. Considering the yields from the standpoint of the different widths of row, regardless of the distance of thinning, the best yield was obtained from the plats in 24-inch rows, the average yield of 15 plats being 18.05 tons per acre. The best distance of thinning regardless of the width of row was 8½ inches, the average yield of 9 plats being 17.70 tons per acre.

Control of the sugar-beet root louse.—In cooperation with the biology department of the Montana Agricultural Experiment Station an experiment was conducted to determine means of controlling the sugar-beet root louse. In nearly all parts of the Yellowstone Valley the beet crop is damaged to some extent by the invasion of this pest, and in cases of very bad infestation the yield may be reduced as much as one-fourth. The root louse lives over winter on cottonwood trees and migrates to the beet fields in the latter part of June and early in July. It may live over winter in the soil of old beet fields.

Ordinarily sugar beets are not irrigated until the latter part of July. The plan of the experiment provided in one case for keeping the ground thoroughly irrigated and cultivated during the entire season, beginning before the migration period. On another plat the

ground was allowed to become dry early in the season and again during the middle of August.

The plats were one-tenth acre in size and were triplicated in each part of the experiment. The "wet" plats were irrigated five times and cultivated five times during the season. The "dry" plats were given two irrigations and two cultivations. The "wet" plats yielded at the rate of 14.97 tons per acre and only about 30 per cent of the plants were infested at the time the beets were harvested. The "dry" plats yielded 12.34 tons per acre, or 2.63 tons less than the "wet" plats, and about 63 per cent of the beets were infested at harvest time. In similar tests made at Bozeman and at Edgar, Mont., the results were similar to those obtained at Huntley, indicating that the damage resulting from invasions of the root louse can be prevented to a large extent by thorough cultivation and irrigation during the entire season, and especially during the migration period.

WHEAT VARIETIES.

A test in which four varieties of spring wheat were grown in triplicate on one-twentieth-acre plats was conducted in field C–III. The varieties and the average yields per acre of each were as follows: Pringle Champion, 35.4 bushels; Marquis, 30.8 bushels; Dicklow, 29.4 bushels; Stanley, 27.1 bushels. Pringle Champion, which produced the highest yield in the test, is the variety used in the rotation experiments and also as a nurse crop with alfalfa. In all of these tests it has produced good yields and appears to be well suited to conditions on the project.

FERTILIZER TEST.

A test of phosphorus as a fertilizer for oats was made on 12 one-tenth-acre plats in field B–VII. The fertilizer was in the form of acid phosphate, applied at the rate of 300, 500, and 700 pounds per acre. As a check a fourth plat was used on which no fertilizer was applied. The plats in each part of the test were triplicated. The average yield of oats from all of the plats was 84.7 bushels per acre. The variations in yield were so slight as to be insignificant, the greatest variation being only 1.9 bushels per acre. Apparently the crop was not benefited by the application of the fertilizer. These results are similar to those obtained in a like test with wheat, oats, and barley in 1913.

CORN VARIETIES.

In cooperation with the Office of Corn Investigations of the Bureau of Plant Industry and the Montana Agricultural Experiment Station, a test of corn varieties was conducted in field B–V. In this test six varieties of dent corn and five varieties of flint corn were grown.

All of the varieties were fully matured before the date of the first killing frost, which occurred on October 6. The earliest maturing varieties were Gehu Flint and Fort Peck Squaw. Of the dent varie-

ties, Minnesota No. 23 and Northwestern Dent were the earliest to mature.

The varieties and yield per acre of each are given in Table X. The yield, except in the case of Northwestern Dent, is the average of 3 plats. Of Northwestern Dent there were 31 plats.

TABLE X.—*Yields of corn varieties at the Huntley Experiment Farm in 1914.*

Variety.	Date of maturity.	Yield per acre.	
		Grain.	Stover.
		Bushels.	*Pounds.*
Cassia County Flint	Sept. 21	58.6	4,161
Martin's Dent	Sept. 25	58.2	4,591
Triumph Flint	Sept. 21	53.8	6,370
C. I. Selection No. 133	Sept. 28	50.2	4,928
Northwestern Dent	Sept. 15	50.1	3,720
Brown County Yellow	Sept. 25	48.1	3,713
Longfellow Flint	Sept. 28	44.3	2,629
Minnesota No. 13	Sept. 21	40.5	2,579
Gehu Flint	Sept. 5	37.4	2,471
Minnesota No. 23	Sept. 10	37.2	2,387
Fort Peck Squaw	Sept. 5	28.4	2,389

Table X shows that of the dent varieties, Martin's Dent produced the highest yield, although it matured later than some of the others. Northwestern Dent produced a fairly good yield and because of its early maturity is perhaps a better variety to grow in the average season. Triumph Flint produced the highest yield of stover and also a high yield of grain, and for this reason it appears that this variety might be a suitable one to grow for silage. Cassia County Flint produced the highest yield of grain, but three other varieties produced more stover.

TESTS WITH SOY BEANS AND GARDEN PEAS.

At the request of the Montana Agricultural Experiment Station, small tests of a number of varieties of soy beans and garden peas were conducted in 1914. Of six varieties of soy beans, four matured before the date of the first fall frost. The highest yielding variety produced 550 pounds of seed per acre. Seven varieties of garden peas were grown. The two highest yielding varieties were Alaska and Gradus, which yielded 846 pounds and 692 pounds per acre, respectively.

IRRIGATION TEST WITH FLAX.

A test to determine the best time of applying water to flax was conducted on 8 one-tenth-acre plats in field C–V. The plan of the test was as follows:

(1) Two irrigations, the first applied when the flax was in full bloom and the second about two weeks later.

(2) One irrigation applied at about the time when the flax began to bloom.

(3) One irrigation after the flax was through blooming.

(4) One irrigation before planting and no further irrigation during the season.

The yields obtained are in favor of two irrigations. The average yield of two plats that were irrigated twice was 15.7 bushels per acre. The lowest yields were secured from the plats that were irrigated only before planting. The average yield of two plats irrigated only before planting was 3.4 bushels per acre. On the plats that were irrigated after the flax was through blooming there was a tendency for the plants to start a second blooming following the irrigation, although this was not enough to interfere seriously with the crop.

ORCHARD TREES AND SMALL FRUITS.

In a test of fruit-tree varieties started in 1911 on a 5-acre tract in field A, about 100 varieties of apples, cherries, and plums have been tried. A large number of these trees have been lost by winterkilling each winter since the test was started. In the winter of 1911–12 about 50 per cent of the trees were winterkilled. These were replanted in the spring of 1912. The loss during the winter of 1912–13 was about 15 per cent. In the winter of 1913–14 about 54 per cent of the trees that were living in the fall of 1913 were winterkilled.

Of 50 varieties of apple trees tried, the following 10 varieties have so far proved to be the most hardy: McIntosh, Wealthy, Patten's Greening, Alexander, Livland, Radiant, Fameuse, Longfield, Yellow Transparent, and University. All of the 11 varieties of crab apples planted in 1911 have proved hardy, and several of these bore small crops of fruit in 1914. Of 27 varieties of plums planted in 1911, all of the trees of the following varieties were alive in the spring of 1914, and many of these bore small crops of fruit: Hammer, Wyant, Terry, Weaver, De Soto, Wolf, German Prune, Surprise, Compass Cherry, Aitkin, and Forest Garden. Eight varieties of sweet cherries and fourteen varieties of sour cherries have been tested. None of the sweet cherries and only a few of the sour cherries have proved hardy. The following varieties of sour cherries were injured least by winterkilling: Late Kentish, May Duke, Large Montmorency, Ostheim, and Homer.

Good results have been obtained with most of the varieties of small fruits planted in 1911, and all of these bore fairly large quantities of fruit in 1913 and 1914. These included blackberries, raspberries, gooseberries, currants, June berries, and strawberries. It has been found necessary to cover the blackberries and raspberries during the winter to prevent freezing back. This has been done by laying the plants down in the row and covering them with soil about 6 or 8 inches deep.

EXPERIMENTS IN THE RECLAMATION OF THE WORDEN TRACT.

Experiments have been under way since 1910 on 12 acres of a 40-acre tract of land adjacent to the Worden town site. The soil on this tract is a very heavy impervious clay and contains alkali salts in

rather excessive amounts. The work in 1914 was devoted mainly to the growing of crops on land which in previous years had received different treatments intended to reduce the salt content and improve the physical condition of the soil, although a part of fields M–I and M–I–A was planted to winter rye and sweet clover to be turned under as green manure.

The work of reclaiming this land has been retarded by the rapid rise of ground water over this area since 1912, so that the crop returns in 1914 were not as satisfactory as in 1913. The average depth to ground water during 1914, as determined by biweekly measurements made in five wells on the tract, was 3.09 feet. The date of the highest water level was May 15. On this date the average depth to water in

FIG. 6.—Winter wheat on plat M–I–A–5, where the land had received no treatment previous to its being broken up in 1913. In 1914 the wheat yield on this plat was only 3.6 bushels per acre. Compare with figure 7.

the five wells was 2.08 feet. In one well on this date the reading was 1.36 feet. Since that date there has been a gradual lowering of the ground water as a result of a cut-off drain that was installed above this tract in May and June. The depth to ground water on January 1, 1915, was 3.77 feet.

Determinations of the total salt content made in 1914 compared with similar determinations made since 1911 indicate that the quantity of salt has increased over that in 1912 and 1913, especially in the surface 2 feet, accompanying the rise of the ground water.

The land on which these experiments have been conducted, including fields M–I and M–II, was broken up in the fall of 1910. Something of the effect of treatments applied can be seen in figures 6 and 7.

A field adjoining field M–I was broken up in 1913, and in 1914 was planted to the same crops as field M–I as a check on the value of the

treatment applied to the land broken up in 1910. Three different methods of treatment were applied to this land in 1911 and 1912. On all of field M–II and on 14 one-quarter-acre plats in field M–I a crop of winter rye was plowed under in 1911 and 1912. Field M–II was cropped to winter wheat in 1913 and produced at the rate of 28.7 bushels per acre. This field was planted to alfalfa in the spring of 1914 and a good stand was secured. The crops on plats in field M–I produced good yields in 1913. The crops grown in 1914 on this land and the yields of each were as follows: Winter wheat, 11 bushels per acre; spring wheat, 10 bushels per acre; oats, 25 bushels per acre; barley, 12.3 bushels per acre; sugar beets, 5.21 tons per acre; and alfalfa, planted in 1913, 2.24 tons per acre. While these yields

FIG. 7.—Winter wheat on plat M–I–5, which adjoins the plat shown in figure 6 and received the green-manure treatment in 1911 and 1912. In 1914 this plat produced 10.2 bushels per acre, as compared with 3.6 bushels on the untreated plat shown in figure 6.

were rather low as compared with those secured in 1913, the yields of similar crops in field M–I–A, which was broken up in 1913, and which had received no previous treatment, were much lower and the growth of the crops was much less uniform.

On two plats in field M–I a crop of rye was plowed under in 1911, and during the remainder of that season and in 1912 the land was given frequent alternate irrigations and cultivations. In 1913 oats on one of these plats yielded 51.5 bushels per acre and in 1914 on the same plat winter wheat yielded 7.4 bushels per acre. On the other plat, alfalfa that was planted in 1913 yielded 2.97 tons per acre in 1914.

A third method of treatment was applied to three plats in field M–I in 1911 and 1912. This was the same as the second method pre-

viously described except that the land was manured each year at the rate of 20 loads per acre. In 1913 spring wheat on this land yielded 36 bushels per acre; sugar beets, 7.86 tons per acre; and oats, 68.9 bushels per acre. In 1914 sugar beets on the land that was cropped to spring wheat in 1913 yielded 11.26 tons per acre. A view of this plat is shown in figure 8. In all cases the yields of the crops in field M–I–A in 1914 were much less than the yields of similar crops in field M–I, where the land had been treated according to the two last-described methods.

FIG. 8.—Sugar beets on plat M–I–17. This plat received green manure in 1911 and barnyard manure in 1911, 1912, and 1913. In 1914 it yielded at the rate of 11.26 tons of beets per acre.

It appears that the methods of treatment which have been tried on this land are effective in reducing the salt content of the surface soil to a point which is not detrimental to the common field crops of the project; but permanent reclamation can not be expected until the drainage system which is now under construction is effective in permanently lowering the ground water.

Approved.

WM. A. TAYLOR,
Chief of Bureau.

APRIL 19, 1915.

WASHINGTON : GOVERNMENT PRINTING OFFICE : 1915